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Agriculture and the Environment: The Gambia Case Study

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Summary

USAID has supported sustainable agricultural development activities in The Gambia since the late 1970s. During the 14-year period 1978-1992, about $30.3 million was obligated to support three projects in soil and water management, mixed farming and range management, and agricultural research and diversification. The results of the $4.96 million soil and water management project, which was most directly related to sustainable agriculture, are quite dramatic. The project had important environmental benefits as well as economic and social benefits. The other two projects contributed less directly to sustainable agriculture, and their results were less dramatic.

The technologies introduced by USAID under the soil and water management project helped to rehabilitate and protect from salinization the lowland rice soils near the Gambia River; they also protected soils on the upland slopes from erosion and nearby villages from flooding. As a result, saline soils that were gradually becoming uncultivable could be cultivated again; crop yields (primarily rice) increased significantly (oftentimes doubling in the first year after protective measures were applied); water tables rose; and soil and gully erosion was reduced. Because women are typically the rice growers in The Gambia, they were among the major beneficiaries.

The success of the program can be attributed to four main factors: (1) the conservation technologies that USAID introduced produced significant results in a short period of time; (2) the demand for the technologies was bottom up, not top down; (3) institution building at the national level and participation at the local level were emphasized; and (4) the new technologies were simple to implement, easy to maintain, and required few changes in farmers' existing practices.

The program was effective in that it reached the population it intended to benefit and all those who could benefit had an equal opportunity to do so. During 1978-1991 the benefit-cost ratio was negative at 0.76:1. At a discount rate of 10 percent, the break-even year is 2006, when project benefits just equal project costs and the benefit-cost ratio is 1. When the initial costs are treated as sunk costs and the program is viewed over the period 1992 to the break-even year (2006), the estimated ratio is positive

at 5.18:1. Thus, each $1 expended from 1992 to 2006 delivers $5, a very good return.

The Soil and Water Management Unit (SWMU), which USAID created and supported over 13 years, is a strong institution that is sustainable as long as it receives adequate budgetary support. The program is replicable (since the soil and water conservation technologies can be implemented throughout the country) given continued access to technical design expertise currently provided by SWMU.

Background

The vast majority of The Gambia's population depends directly on the country's natural resource base for food, energy, and income. However, the natural resource base has been weakened and degraded over time as a result of population growth and a decline in rainfall.

Traditional resource management practices in The Gambia have not been effectively adapted to these two long-term trends. The result has been environmental degradation, which has had direct adverse economic consequences.

The decline in rainfall has allowed saltwater to intrude more extensively into the Gambia River valley, and the resulting salinization of floodplain rice paddies has reduced the available land on which to grow rice.

Deforestation has resulted in increased rainfall runoff, soil erosion, loss of biodiversity, and reduced soil fertility.
Soil erosion and reduced soil fertility have led to decreased crop yields and to expansion of crop area at the expense of the livestock sector.

Overgrazing and the displacement of livestock onto marginal lands have resulted in rangeland degradation as well as poor animal nutrition and lower milk and meat production.

A four-person team conducted an assessment of the environmental impact of USAID's support to sustainable agriculture in The Gambia during a 4-week period in October 1993, 15 years after USAID had begun to support soil and water conservation activities.
The team based its findings on a careful review of existing documentation, especially past evaluations; structured interviews with persons and organizations in The Gambia knowledgeable about USAID-supported programs in sustainable agriculture; and, perhaps most important, visits to 10 sites in all 5 administrative regions of the country to assess impact from the perspective of the intended beneficiaries (see map).

USAID's Assistance Approach

USAID's support of sustainable agricultural development was provided primarily under three projects: the 13-year, $4.96 million Soil and Water Management (SWM) project (1978-1991); the 7-year, $9

million Mixed Farming and Resource Management project (MFP) (1979-1986); and the 6-year, $16.3 million Gambia Agricultural Research and Diversification (GARD) project (1986-1992). Although all three activities contributed to sustainable agricultural development in The Gambia, every component of the soil and water management project was squarely focused on reducing environmental degradation and improving agriculture. The approach USAID used under that project was to introduce appropriate conservation technologies and to create (and then strengthen) a government institution to carry out conservation activities. Thus, appropriate technologies combined with strong technical assistance and training were fundamental to USAID's approach.

The approach worked. The construction of saltwater intrusion dikes and water retention dams in the lowlands and contour berms and grass waterways in the uplands the principal technologies introduced by USAID had significant biophysical and socioeconomic impacts. The infrastructure rehabilitated and protected saline soils in the lowland swamps, and it protected soils from erosion on the upland slopes. As a result, saline soils in the lowlands could be cultivated again; crop yields, particularly of swamp rice, increased significantly (doubling in the first year); water tables rose; and soil and gully erosion in the uplands was reduced. Because women are typically the rice growers in The Gambia, women were among the major beneficiaries of the activity.

Evaluation Findings

The success and accomplishments of the project can be attributed to four main factors:

The technologies that were introduced produced significant benefits in a relatively short period of time, and this contributed to high adoption rates.

The demand for the new technologies originated with the intended beneficiaries; the beneficiaries, not the donors or the government, determined what was needed, and they backed up this demand by volunteering their labor to construct the dikes.

The new technologies were simple to implement, relatively easy to maintain, placed only minimal demands on additional labor, and required few changes in farmers' existing cropping practices. SWMU, which had been created and continuously supported by USAID year after year for 13 years, developed into a strong institution that provided sound technical advice.

Of the four approaches that tend to be associated with successful sustainable agricultural programs worldwide, the program in The Gambia is most closely linked to two: the introduction of appropriate technologies and the support of strong institutions. Awareness and education appeared to play a less important role, although various activities had been supported to promote awareness of the importance of soil conservation at both the village and national levels. Similarly, the economic policy environment, which changed substantially over the 15-year period, appeared to have a

neutral effect, largely because rice is a subsistence crop and the incremental rice production was consumed domestically and was not sold on the market.

Strong national institutions are important. SWMU developed into a strong institution partly because USAID recruited competent and committed technical advisers during the critical early phases of its establishment. In addition, USAID supported a strong training component. By far the majority of those trained under the SWM project returned to apply their skills in their departments of origin. Of the 19 Gambians who received degree- and diploma-level training, 15 were still working with SWMU in 1988, 3 had been seconded to other agriculture divisions, and 1 had retired. Since 1988, eight additional Gambians have been trained under the SWM project, of whom four are working with SWMU and four are working in other agricultural divisions. Similarly, the majority of Gambians trained under the MFP and GARD projects occupied senior public service positions in their areas of specialization, or they were actively applying their skills in the private sector or with nongovernmental organizations (NGOs).

There remains, however, a critical shortage of management skills on the part of senior and midlevel Gambian officials. Although training in technical fields is crucial, staff with skills in management and administration are needed as well.

Local institutions and local participation are also important. USAID sought to encourage the participation of local institutions and populations in sustainable agriculture activities. As the two cases below illustrate, the linkage or lack thereof between peoples' participation in a common effort and the benefit that is derived from such participation was a critical factor explaining the relative success of the program.

In the case of the SWM project, local communities decided at the outset to distribute benefits in an equitable manner among all participants. In effect, each adult woman received at least one plot of land for swamp rice cultivation in the area reclaimed by the infrastructure; this meant that every family would benefit, including all those within the domestic household, and that no groups or individuals would be losers. Thus, there was a clear linkage between participation and benefits. Participation was more widespread, however, in the construction and maintenance of the saltwater intrusion barriers in the lowlands than in the construction and maintenance of the contour berms in the uplands, probably because the benefits were greater and materialized more quickly.

A very different experience resulted under the MFP project, which aimed at establishing grazing plots to test improved forage and grass varieties. In contrast to the SWM project, the demand for the range management activity came from outside the population that was to benefit, little actual contribution was required or expected of those who were to benefit, and access to the common resource (and thus to its benefits) was not controlled. As a result, livestock numbers quickly exceeded the carrying capacity of the small trial

plots resulting in overgrazing, and despite recognition by the Livestock Owners Association and its members that the test varieties provided good dry season pasture, no attempt was made to spread their use.

Program Impact

The USAID-supported sustainable agriculture program in The Gambia had a substantial biophysical, as well as socioeconomic, impact.
Biophysical Impact. During the 9-year period 1983/1984 through 1992/1993, SWMU rehabilitated 1,611 hectares of land planted to lowland rice; this equals about 15 percent of total lowland rice area in The Gambia (see table). During the same period, upland conservation structures were installed on 1,920 hectares, nearly all of which are planted to maize, millet, grain sorghum, and groundnuts; this represents about 1.3 percent of the total land planted to these upland crops.

Economic Impact. The economic impact of the soil and water conservation technologies was impressive. Within one to two seasons, average rice yields increased by 108 percent, from 1.3 to 2.7 tons per hectare. In one village, women confirmed that they were able to harvest from one plot what they typically had harvested from three plots before the saltwater intrusion dike was constructed. In Njawara, rice was harvested on plots that had not been cultivated for over a decade. In upland areas, the construction of contour berms and other water retention and antierosion measures resulted in increased production of millet, sorghum, corn, and peanuts.

Increased production contributed to increased incomes. An improved maize variety was promoted and widely adopted, and this became a new cash crop for farmers. Likewise, crop residues, such as groundnut hay and corn stalks, were promoted for the purpose of ram fattening, and this, too, helped to increase farmer incomes. Finally, the increased water retention resulting from conservation infrastructure allowed women to raise vegetables as cash crops during the dry season following the rice harvest.

Increased production also contributed to improved food security. Respondents at all sites where saltwater intrusion barriers had been constructed uniformly confirmed that the increased food that was produced was consumed within the household. Both men and women repeatedly pointed out that the saltwater intrusion barriers allowed the family to eat for months without being obliged to purchase rice or other food stuffs. The money saved could then be used for other needs. Improved range management and the practice of feeding crop residues to animals served to diversify production activities, thereby improving food security by spreading the risk across a larger number of food- and income-generating activities.
Social Impact. There were social benefits as well as economic benefits. The combination of contour berms, reinforced roadways, and grass waterways effectively ended flooding in the village of Njawara. Also, women regained control over subsistence production in their traditional fields, and women were the primary beneficiaries of the new income-earning activities, such as

vegetable production and ram fattening.

Program Performance

The sustainable agriculture program in The Gambia was not only effective and efficient, but is also sustainable and, to a large extent, replicable.

Effectiveness. Generally speaking, a program can be judged effective if it reaches the population it intends to benefit, if all who can benefit from the activity have an equal opportunity to do so without undue restriction, and if the results are generally those that were anticipated and desired in the design of the activity. On all three counts, the soil and water conservation activities supported by USAID were effective.

In large measure, the high degree of effectiveness was due to (1) the selection of comparatively simple, low-cost, and easy-to-maintain technologies; (2) the direct and almost immediate linkage between the problem and the proposed solution, that is, the loss of productivity due to saltwater intrusion and the construction of a saltwater barrier; (3) the ability to demonstrate significant, short-term benefits to those participating in the activity; and (4) the willingness of community members to redistribute equitably reclaimed and new lands brought into production.

Efficiency. In 1991 the U.S. Soil Conservation Service carried out an economic analysis of the soil and water conservation activities in The Gambia. During the 13-year project period, 1978-1991, the benefit-cost ratio was 0.76 to 1: benefits were less than costs, indicating that the project was not economically viable over that time period. At a discount rate of 10 percent, the break-even year is 2006, when project benefits just equal project costs and the benefit-cost ratio is 1. When the period of analysis excludes the donor phase (treating those expenditures as sunk costs) and instead includes only the 14-year period from 1992 to 2006 (the break-even year), the benefit-cost ratio is 5.18 to 1: each dollar expended returns more than 5 dollars, which is a very attractive return.
Sustainability. USAID, through SWMU, funded the initial soil and topographic surveys and design work required to construct saltwater intrusion dams. A tractor was also provided to loosen the soil used to construct the dikes and to transport stones and cement used to construct small spillways. These initial costs were substantial and probably not amenable to recovery from poor rural villagers. The program therefore, will probably never be financially self-sustaining if it has to depend on beneficiaries to bear the initial costs of construction and equipment. Most of these costs must be borne by the Government or other sources. The villagers, however, are likely to continue to bear the cost of operation and maintenance of the saltwater instusion dams and other infrastructure as they have since these were built.

USAID's efforts at strengthening Gambian technical services have been very successful in terms of the quality of technical personnel and overall performance. SWMU, in particular, represents one of the more productive, technically capable, and dedicated services likely

to be encountered in Africa. However, the long-term sustainability of this and other institutions requires adequate budgetary support from the Government or other sources to ensure continued operation. Moreover, the retention of trained personnel in the absence of a competitive salary structure will be difficult.

Replicability. Soil and water conservation concepts, implementation procedures, and maintenance are replicable within rural communities, but the design of conservation structures requires technical expertise that cannot be found among the beneficiary populations. The complex nature of the design of saltwater intrusion dikes and retention dams places a premium on having a well-trained group of professionals, such as the staff in SWMU, available to design the structures and to supervise their construction. Also, in the early phases of implementation the technology requires substantial up-front costs. Thus, the technology can be replicated, but only if resources are available to finance the frontend cash outlays and to fund the cadre of trained professionals needed for the design and supervisory work.

Lessons Learned

A new agricultural technology or practice is more likely to be adopted when the intended users have few other options for achieving food security. This was the case in The Gambia, where over the past 25 years reduced rainfall levels had permitted extensive saltwater intrusion in the lowland rice fields thereby making the land virtually unproductive; reduced rainfall also made upland cultivation of groundnuts, maize, millet, and grain sorghum increasingly less productive. The construction of saltwater intrusion dikes in the lowlands and contour berms in the uplands the principal technologies introduced by USAID stops saltwater intrusion, impounds rainfall runoff, and reduces soil erosion. This, in turn, permits significant increases in lowland acreage and total production (both lowland and upland), and at the same time enhances the natural resource base and improves the environment.

Technologies that yield significant benefits in a relatively short period of time are more likely to be adopted than those that yield positive (but less dramatic) benefits only over the longer term. In The Gambia, rice production doubled and sometimes tripled in 1 year in areas where the saltwater intrusion dams had been constructed. The benefits from contour berms were typically less immediate and less appreciable, and adoption of this technology was less widespread.

Technologies for which there is a clear demand on the part of the intended beneficiaries are more likely to be adopted and sustained than those that are proposed (or imposed) by governments, donors, NGOs, or other external entities. In The Gambia, the interests and priorities of the intended beneficiaries were demonstrated in two ways: first, by beneficiaries initiating a request for the design of a saltwater intrusion dam specific to their locality and, second, by volunteering their labor to construct and maintain the dam.

A new technology is more likely to be adopted if it is easy to maintain, places only minimal additional demands on labor, and requires few changes in existing practices. In The Gambia, the saltwater intrusion dams satisfied all three of these criteria; in particular, farmers were able to benefit from the dams without altering their traditional cropping practices.

Collective action is most effective when there is a clear linkage between peoples' participation in a common effort and the benefit that is derived from such participation, and, when the work can be completed relatively quickly. In The Gambia, those who worked to construct and maintain the saltwater intrusion dams clearly reaped the benefits afforded by the dams in the form of increased rice yields; the work typically required about 12 days over the course of 1 month during the first year, and less than 1 week each year thereafter. Local organizations often played a catalytic role by encouraging collective action and participation.

Strong institutions at the national level, which are essential for designing technically complex conservation infrastructure, require a long time to develop and mature. USAID supported The Gambia's Soil and Water Management Unit (SWMU) for 13 years, and staying the course has had a large payoff.

The maximum benefits of conservation technology can be achieved and sustained only if the users of the technology have continued access to technical advice. Thus, institutions, once developed, must be given adequate financial and human resources on a regular basis so they can provide technical advice at the local level. In light of the retrenchment that has occurred in the public sector in The Gambia, it is not clear that adequate budgetary support is being provided to SWMU.

The incentive to adopt a technology is not always market driven. In The Gambia, rice is a preferred food that is produced primarily for home consumption rather than for sale. However, if the objective were to produce a marketable surplus of rice (or any other commodity, such as vegetables or livestock), a market in which to sell that surplus would be needed as an incentive to adopt the technology.

This Evaluation Highlights was prepared by Donald G. McClelland of the Center for Development Information and Evaluation. It summarizes the findings from "Sustainable Agriculture and the Environment: The Gambia Case Study," CDIE Working Paper No. 156, which can be ordered from the DISC, 1611 North Kent Street, Suite 200, Arlington, VA 22209-2111, telephone (703) 351-4006; fax (703) 351-4039.